Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number | | | | | |

Candidate Number | | | | |

Wednesday 10 June 2020

Morning (Time: 1 hour 45 minutes) | Paper Reference **1CH0/2F**

Chemistry

Paper 2

Foundation Tier

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- A periodic table is printed on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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P 6 2 0 8 4 A 0 1 3 2

Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) The two most common gases in today's atmosphere are nitrogen and oxygen.

(i) What is the third most common gas in today's atmosphere?

(1)

☒ **A** argon

☐ **B** butane

☐ **C** chlorine

☐ **D** hydrogen

(ii) What is the percentage of oxygen in today's atmosphere?

(1)

☐ **A** 0.04

☐ **B** 1

☒ **C** 21

☐ **D** 78

(b) Give the name of the most common gas in the Earth's **early** atmosphere.

(1)

carbon dioxide

(c) This early atmosphere was hot and contained water vapour.
The atmosphere today contains less water vapour.

Explain what caused the amount of water vapour in the atmosphere to decrease.

(2)

An explanation linking any two

• Earth cooled (1)

• water (vapour) condensed (1)

• oceans formed /seas formed/ rainfall (1)

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(d) The concentration of carbon dioxide in the atmosphere can be measured in parts per million (ppm).

Figure 1 shows the measurements in January 2018 and January 2019.

	concentration of carbon dioxide in ppm
January 2018	407.96
January 2019	410.83

Figure 1

(i) Calculate the increase in the concentration, in ppm, of carbon dioxide from January 2018 to January 2019.

Give your answer to the nearest whole number.

(2)

change in concentration = 410.83 - 407.96 (= 2.87) (1)
= 3 (1)

increase in concentration of carbon dioxide = 3 ppm

(ii) Give a possible cause for this increase in the concentration of carbon dioxide.

(1)

volcanic activity / burning of fossil fuels / deforestation / respiration

(Total for Question 1 = 8 marks)

2 (a) Figure 2 shows information about three different materials, a composite, a glass and a metal.

	a composite	a glass	a metal
density	low	high	high
ability to conduct electricity	poor	poor	good
resistance to corrosion	good	good	poor

Figure 2

Explain which material in Figure 2 is the most suitable material to use in electrical circuits.

(2)

An explanation linking
• metal (1)
• good conductor (of electricity) (1)

(b) (i) Nanoparticles are very small.

Some nanoparticles have a radius of 17 nm.
The radius of a magnesium atom is 0.16 nm.

Approximately how many times larger is the radius of these nanoparticles than the radius of the magnesium atom?

(1)

☒ **A** 0.01

☒ **B** 0.10

☒ **C** 10

☒ **D** 100

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(ii) A catalyst contains cube-shaped nanoparticles.
Figure 3 shows a diagram of a cube-shaped nanoparticle.

The length of each side of the cube is 9 nm.

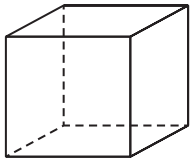

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Figure 3

Calculate the surface area of the cube, in nm^2.

(2)

surface area of 1 side of cube
= 9 x 9 (1) (= 81 (nm2))
total area of cube
= 6 x (9 x 9) (1) (= 486 (nm2))

surface area = 486 nm^2

(iii) Nanoparticles have many uses.
Some scientists are concerned about the possible risks of using nanoparticles.

Give **one** possible risk of using nanoparticles.

(1)

damages cells/heart problems/get into the bloodstream/pass into cells/catalysing harmful reactions/harmful to aquatic life

(Total for Question 2 = 6 marks)

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3 (a) A student investigated the reaction between potassium iodide and lead nitrate.

(i) Solutions of potassium iodide and lead nitrate were mixed together.
Lead iodide and potassium nitrate were formed.

Complete the word equation.

(2)

potassium + lead (1) → lead + potassium (1)

iodide + nitrate → iodide + nitrate

(ii) The student recorded the total mass of the reactants and the total mass of the products.

The results are shown in Figure 4.

	reactants	products
total mass in g	21.7	21.7

Figure 4

State how the results in Figure 4 show that mass is conserved in this reaction.

(1)

(mass conserved because) the numbers are the same/nothing is lost/nothing is gained

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(b) In another experiment, a student investigated the temperature decrease when different amounts of ammonium nitrate crystals were dissolved in 100 cm^3 of water.

The apparatus used is shown in Figure 5.

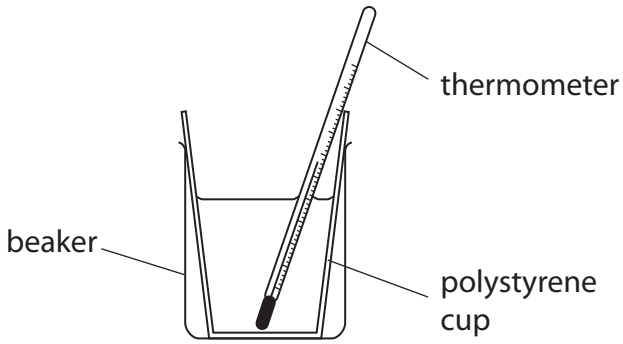


Figure 5

The student used the following method.

step 1 pour 100 cm^3 of water into the polystyrene cup

step 2 add one spatula of ammonium nitrate crystals to the water

step 3 stir the mixture

step 4 use the thermometer to record the lowest temperature reached by the mixture

step 5 repeat steps 1 to 4 using different amounts of ammonium nitrate

(i) Name a piece of apparatus that should be used to measure the 100 cm^3 of water in **step 1**.

(1)

measuring cylinder / (volumetric) pipette / burette

(ii) The student cannot work out the temperature decrease using the method described.

State what the student must do before **step 2** to be able to work out the temperature decrease.

(1)

measure the initial temperature (of the water)

(iii) State why a polystyrene cup is used in this experiment.

(1)

insulator / reduces heat transfer / poor conductor of heat

(iv) Figure 6 shows the reaction profile for this reaction.

Use the words from the box to complete the labels on Figure 6.

activation energy	products	reactants

(2)

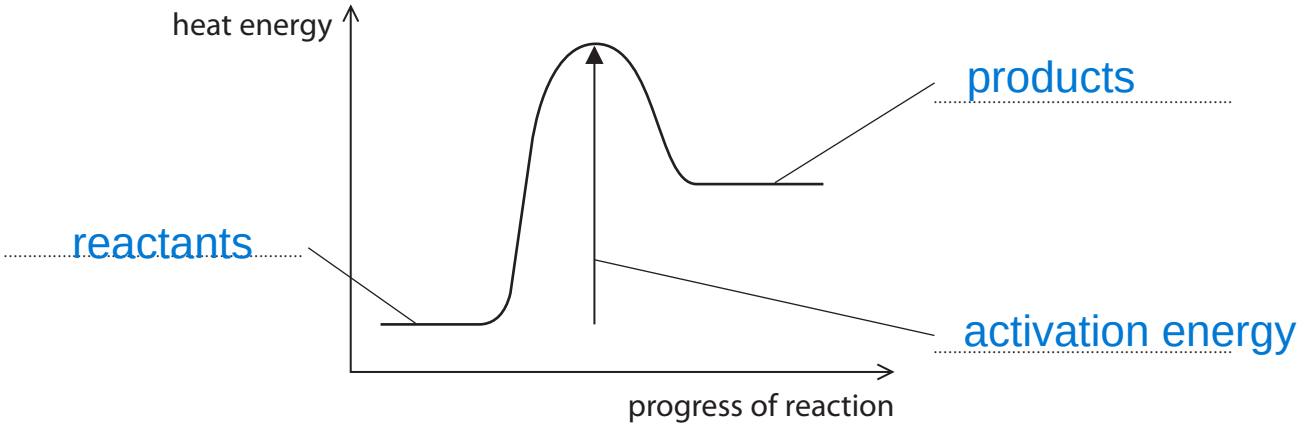


Figure 6

(Total for Question 3 = 8 marks)

4 Tests are carried out to identify the ions in two solids, **P** and **Q**.

(a) A flame test is used to identify the metal ions in each of these solids.

(i) Describe how to do a flame test.

(2)

A description including

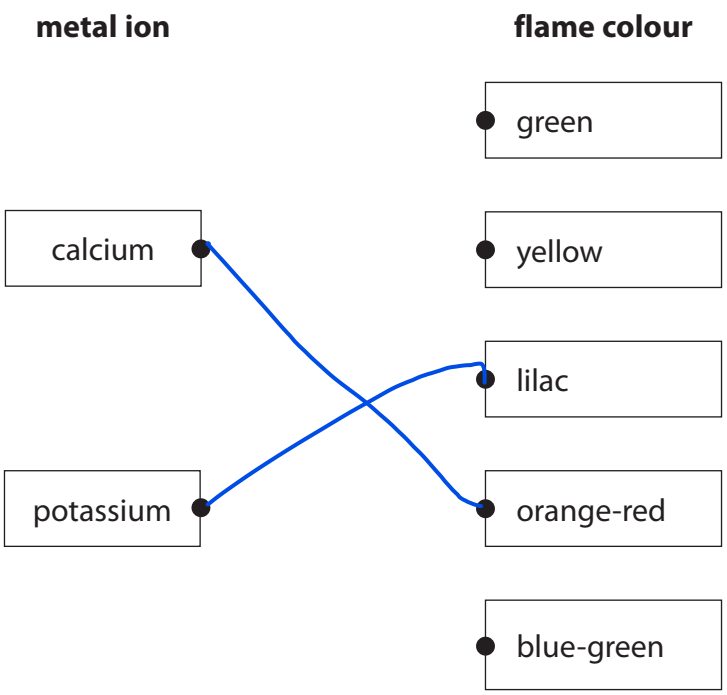
• put (clean) wire into solid (1)

• hold (wire) in (Bunsen) flame (1)

(ii) Different metal ions produce different coloured flames.

Draw one straight line from each metal ion to its flame colour.

(2)



(b) **P** and **Q** dissolve in water to form colourless solutions.

Figure 7 shows the results of tests on these solutions.

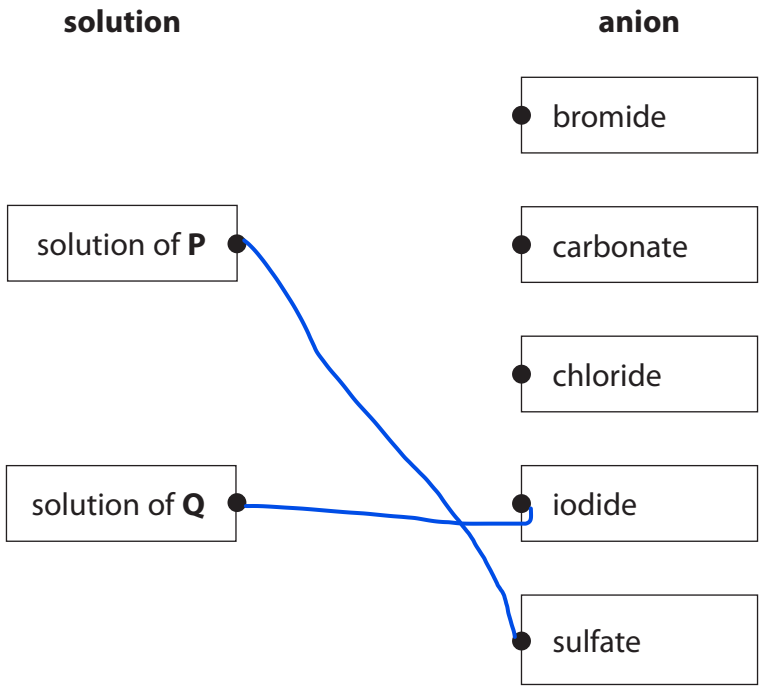
test	results	
	solution of P	solution of Q
dilute hydrochloric acid added, then barium chloride solution	a white precipitate	remains colourless
dilute nitric acid added, then silver nitrate solution	remains colourless	a yellow precipitate

Figure 7

(i) The anions in solutions of **P** and **Q** can be identified from the results of the tests shown in Figure 7.

Draw one straight line from each solution to the anion present.

(2)



(ii) The formula of barium chloride is $BaCl_2$.

Give the total number of ions in the formula $BaCl_2$.

(1)

3

(c) A few drops of sodium hydroxide solution are added to a solution of iron(II) sulfate. Iron(II) hydroxide is formed.

(i) State what would be **seen**.

(2)

• green (1)
• precipitate / (insoluble) solid (1)

(ii) One other product is formed in this reaction.

What is the name of this other product?

(1)

☒ **A** iron(II) chloride

☒ **B** sodium chloride

☒ **C** sodium sulfate

☒ **D** water

(Total for Question 4 = 10 marks)

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5 Chlorine, bromine and iodine are elements in group 7 of the periodic table.

(a) Chlorine is toxic.

State **one** safety precaution that should be taken when using chlorine in the laboratory.

(1)

use of fume-cupboard / fume hood

(b) Chlorine reacts with hydrogen to form hydrogen chloride.

(i) Write the word equation for this reaction.

(1)

hydrogen + chlorine → hydrogen chloride

(ii) Hydrogen chloride dissolves in water to form an acidic solution.

State what is **seen** when blue litmus paper is placed into this solution.

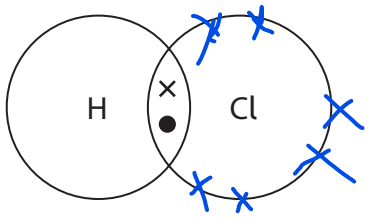
(1)

(turns) red /pink

(iii) A chlorine atom has seven electrons in its outer shell.
A hydrogen atom has one electron in its outer shell.

Complete the dot and cross diagram of a molecule of hydrogen chloride.
Show outer shell electrons only.

(1)



(iv) Name the type of bonding in a molecule of hydrogen chloride.

(1)

covalent

(c) If chlorine solution is added to sodium bromide solution a reaction occurs.

chlorine + sodium bromide → sodium chloride + bromine

Give a reason why this reaction occurs.

(1)

chlorine is more reactive than bromine / chlorine can displace bromine

(d) Figure 8 shows apparatus used to find out if a solution conducts electricity.

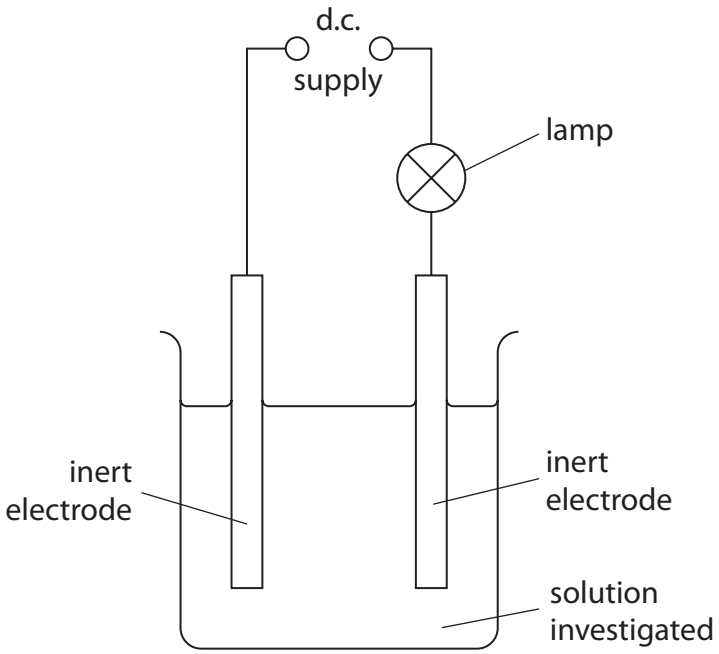


Figure 8

Glucose solution and sodium chloride solution are tested.
Glucose is a typical simple molecular covalent compound.
Sodium chloride is an ionic compound.

(i) State what would happen to the lamp when glucose solution is tested.

(1)

(lamp) does not light up / unlit / 'nothing'

(ii) State what would happen to the lamp when sodium chloride solution is tested.

(1)

(lamp) lights up / glows / works

(e) Figure 9 shows how the conductivity of one solution changes as its concentration increases.

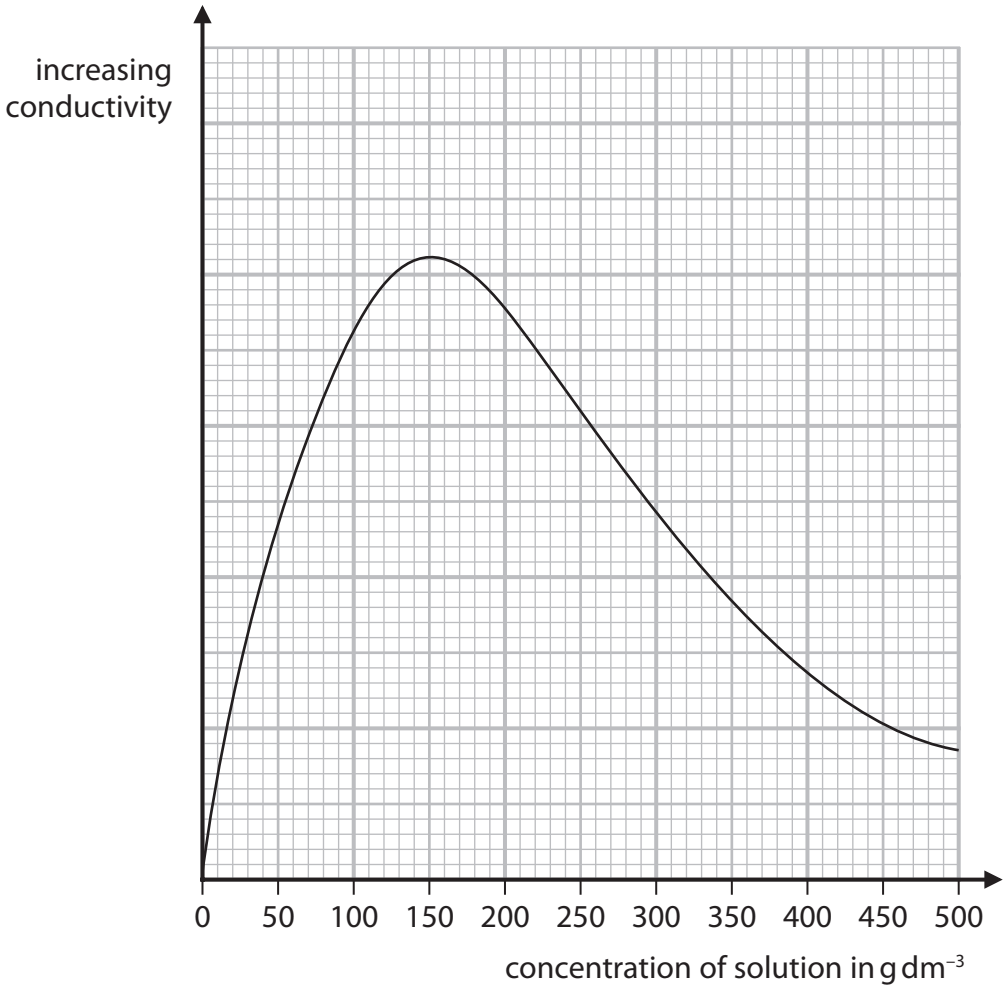


Figure 9

Describe how the conductivity of this solution changes as its concentration increases from 0 to 500 g dm^{-3}.

(2)

A description including
• conductivity increases and then decreases (1)
AND any one quantitative description from
• conductivity increases (from 0) to 150 (g dm-3) (1)
• conductivity reaches maximum at 150 (g dm-3) (1)
• conductivity then decreases from 150 (to 500) (g dm-3) (1)

(Total for Question 5 = 10 marks)

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6 (a) Methane is a hydrocarbon fuel.

(i) Complete the word equation for the **complete** combustion of methane in oxygen.

(2)

methane + oxygen → water + carbon monoxide

(ii) The **incomplete** combustion of methane can produce carbon and carbon monoxide.

Give the reason why carbon and carbon monoxide are produced in the **incomplete** combustion of methane.

(1)

limited supply of oxygen

(b) Crude oil is a complex mixture of hydrocarbons.
Crude oil can be separated into useful fractions by fractional distillation.

Figure 10 shows a fractional distillation column and the fractions produced when crude oil is distilled.

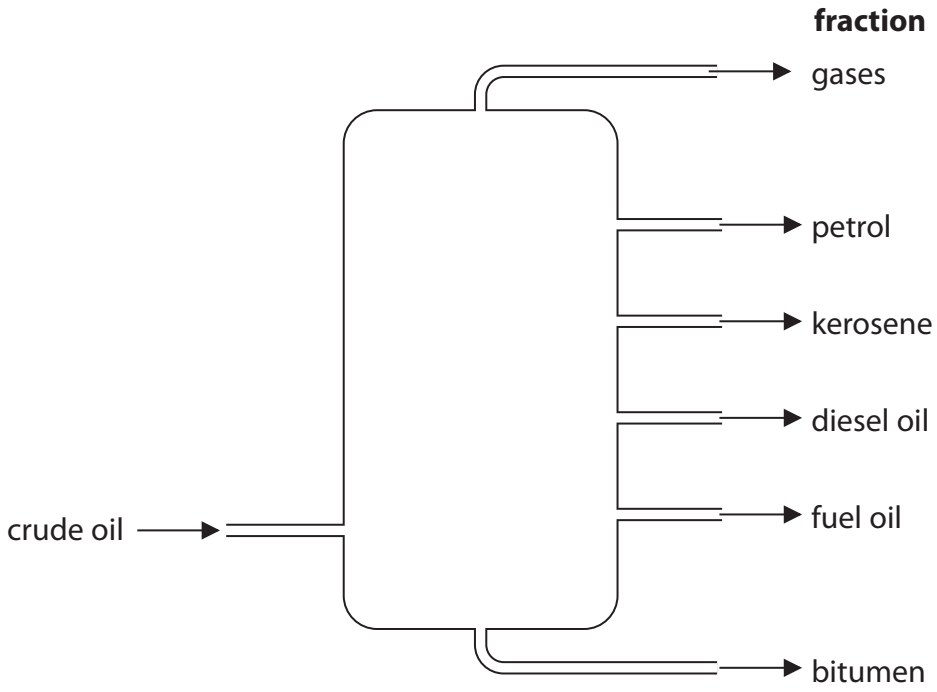

Figure 10

(i) Name the fraction in Figure 10 that is used to surface roads.

(1)

bitumen

(ii) Name the fraction in Figure 10 that contains hydrocarbons with the lowest boiling point.

(1)

gases

(c) When crude oil is fractionally distilled, the demand for some fractions is more than the amount produced.

Figure 11 shows the relative amounts of each fraction in a crude oil and the relative demand for each of these fractions.

fraction	relative amount	relative demand
gases	2	6
petrol	12	29
kerosene	16	11
diesel oil	24	29
fuel oil	37	21
bitumen	9	4

Figure 11

Which of the following shows the fractions where the relative demand is greater than the relative amount in the crude oil?

(1)

☒ **A** kerosene, diesel oil, bitumen

☒ **B** gases, petrol, diesel oil

☒ **C** gases, petrol, kerosene

☒ **D** petrol, diesel oil, fuel oil

(d) Cracking involves the breaking down of large hydrocarbon molecules into smaller hydrocarbon molecules.

(i) Octane, C_8H_{18}, can be cracked to produce one molecule of ethene, C_2H_4, and one molecule of C_xH_{14}.

$$C_8H_{18} \rightarrow C_2H_4 + C_xH_{14}$$

Determine the value of x in the molecule of C_xH_{14}.

(1)

x = 6

(ii) Dodecane is a large hydrocarbon molecule.
When one molecule of dodecane is cracked the products are one molecule of octane and one molecule of butene.

dodecane → octane + butene

Calculate the maximum mass of octane that could be produced when 340 g of dodecane is cracked in this reaction.

(relative formula masses: dodecane = 170, octane = 114)

(2)

170 (g) dodecane forms 114 (g) octane

1 (g) dodecane forms $\frac{114}{170}$ (g) octane (1)

340 (g) dodecane forms $\frac{114}{170}$ x 340 (1)

(= 228(g))

mass of octane = 228 g

(Total for Question 6 = 9 marks)

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7 (a) Ethanol can be produced by the fermentation of glucose solution.

Which of these shows the word equation for the fermentation of glucose solution?

(1)

☒ **A** glucose → ethanol + water

☒ **B** glucose → ethanol + carbon dioxide

☒ **C** glucose → ethanol + hydrogen

☒ **D** glucose → ethanol + water + carbon dioxide

(b) The names and formulae of the first four alcohols in the homologous series of alcohols are given in Figure 12.

name of alcohol	formula
methanol	CH_3OH
ethanol	C_2H_5OH
propanol	C_3H_7OH
butanol	C_4H_9OH

Figure 12

(i) Pentanol is the next member of this series.
A molecule of pentanol contains five carbon atoms.

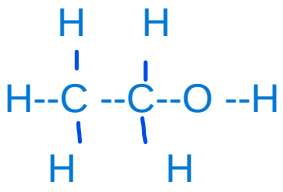
Suggest the formula of a molecule of pentanol.

(1)

C5H11OH

(ii) Draw the structure of a molecule of ethanol.
Show all bonds.

(2)



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(c) Ethanol is present in alcoholic drinks, such as wine.

When a bottle of wine is left open some of the ethanol reacts with the oxygen in the air to form ethanoic acid, CH_3COOH, and water.

(i) Complete the equation for this reaction.

(2)

$$CH_3CH_2OH + \text{O2} \rightarrow CH_3COOH + \text{H2O}$$

(ii) Which calculation shows the percentage by mass of hydrogen in ethanoic acid?

(relative atomic mass of hydrogen, H = 1,
relative formula mass of ethanoic acid, CH_3COOH = 60)

(1)

☒ **A** $\frac{1}{60} \times 100$

☒ **B** $\frac{3}{60} \times 100$

☒ **C** $\frac{4}{60} \times 100$

☒ **D** $\frac{60}{1} \times 100$

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*(d) Polymers have many uses.
However, the disposal of polymers after use can be a problem.
The uses of polymers are related to their properties.

Some uses of three common polymers are given in Figure 13.

polymer	uses
poly(ethene)	plastic bags, plastic bottles
poly(chloroethene) (PVC)	window frames, water pipes, insulation for electrical wires
poly(tetrafluoroethene) (PTFE, Teflon™)	coating for frying pans, stain-proofing for clothing

Figure 13

Discuss the reasons for using these polymers in the ways shown in Figure 13 and the problems in disposing of these polymers.

(6)

(reasons for the uses)
poly(ethene) :
• plastic bags / plastic bottles – flexible/bendable,

inert/unreactive, waterproof/weatherproof, light
poly(chloroethene) :
• window frames / gutters / waterpipes - tough/hard, long lasting, durable/good insulator, waterproof/weatherproof, inert/unreactive

• insulation for electrical wires – flexible /bendable, good insulator,waterproof/weather proof, inert/unreactive

poly(tetrafluoroethene):
• coating for frying pans - slippery, non-stick, tough, high melting point/heat resistant, inert/unreactive

• stain-proofing clothing and carpets – slippery

(problems of disposal)
landfill
- non-biodegradable
- persist in landfill/very long time to degrade
- fill up land/new landfill sites needed
- harmful to animal habitats

recycling
- plastics need to be sorted/time consuming
- transport to collection area/recycling point uses fuel
- collection point may cause litter problem/eyesore etc

burning
- toxic substances released
- hydrogen chloride/acid gas produced from burning PVC
- carbon dioxide released contributing to global warming
- carbon monoxide released
- toxic ash/solids formed

(Total for Question 7 = 13 marks)

8 (a) An atom of potassium has atomic number 19 and mass number 39.

(i) Give the electronic configuration of this potassium atom.

(1)

2.8.8.1

(ii) This potassium atom forms the ion K^+.

Which row shows the number of protons and the number of neutrons in this potassium ion, K^+?

(1)

	number of protons	number of neutrons
☒ **A**	19	19
☒ **B**	19	20
☒ **C**	20	19
☒ **D**	20	20

(b) Potassium and caesium are in the same group of the periodic table.

Explain, in terms of electrons, why potassium and caesium are in the same group.

(2)

An explanation linking

• outer (electron) shell (1)

• (both have) {same number / 1} electron(s) (1)

(c) Fluorine boils at –188 °C.
There are forces between fluorine molecules.

Explain, in terms of these forces, why the boiling point of fluorine is low.

(2)

An explanation linking

• (intermolecular) forces are weak (1)

• little energy needed (to overcome forces) (1)

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(d) Potassium reacts with fluorine to form potassium fluoride.
Potassium fluoride is a solid.

Complete the balanced equation for this reaction and add the state symbols.

(3)

2 K (S) + F_2(g) → 2 KF (S)

(e) What are the elements in group 1 of the periodic table called?

(1)

☒ **A** alkali metals

☒ **B** fullerenes

☒ **C** halogens

☒ **D** noble gases

(f) Figure 14 shows the melting points and boiling points of elements in group 7 of the periodic table.

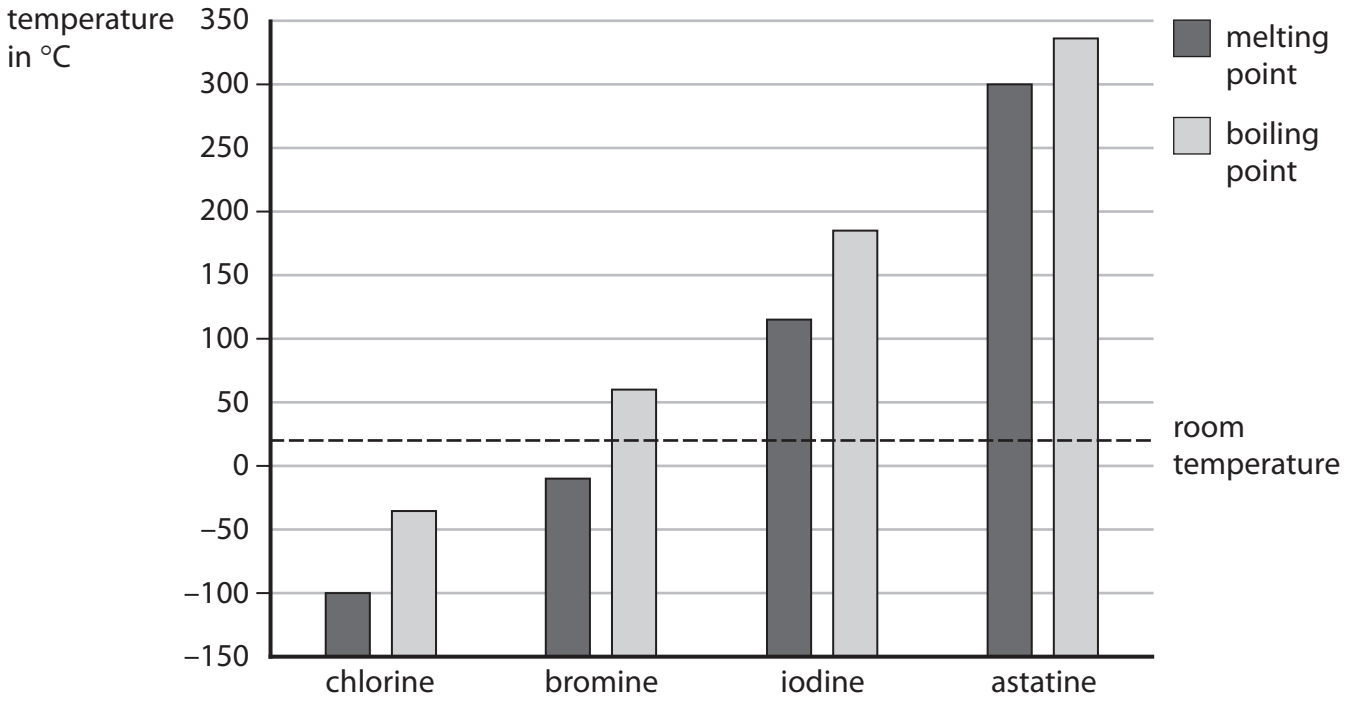

Figure 14

(i) Give, using Figure 14, the boiling point of bromine.

(1)

any value between 51 (°C) and 70 (°C)

boiling point of bromine = ... °C

(ii) State which **two** elements from Figure 14 are solids at room temperature.

(1)

iodine and astatine

(Total for Question 8 = 12 marks)

9 (a) Calcium carbonate reacts with dilute hydrochloric acid to produce carbon dioxide gas.

The rate of reaction between calcium carbonate and dilute hydrochloric acid at room temperature was investigated.

(i) The investigation was carried out with different sized calcium carbonate pieces.

The mass of calcium carbonate and all other conditions were kept the same.

The results are shown in Figure 15.

size of calcium carbonate pieces used	volume of carbon dioxide gas produced in five minutes in cm^3
large	16
small	48
powder	90

Figure 15

State, using the information in Figure 15, the effect of the surface area of the calcium carbonate on the rate of this reaction.

(1)

larger surface area {higher /faster} rate /ORA

(ii) The calcium carbonate powder produced 90 cm^3 of carbon dioxide in five minutes.

Calculate the average rate of reaction in $cm^3\ s^{-1}$.

(3)

MP1 : conversion of time from minutes into seconds
5 x 60 = 300 (seconds) (1)

MP2 : rate = volume / time
rate = 90 (1) / 300

MP3 : evaluation of the fraction

average rate of reaction = 0.3 $cm^3\ s^{-1}$

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(iii) The experiments were repeated at a higher temperature.
The rate of reaction for each experiment increased.

Explain, in terms of particles, why the rate of reaction increased when the temperature was increased.

(3)

particles have more energy (1)

• so (particles) move faster (1)

• (so) there are more frequent collisions between particles (1)

• higher proportion of collisions have at least the activation energy to react when particles collide (1)

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*(b) Zinc metal reacts with dilute hydrochloric acid to produce hydrogen gas.

zinc + hydrochloric acid → zinc chloride + hydrogen

A student investigated the effect of doubling the concentration of the hydrochloric acid on this reaction.

The student made the following prediction.

> When the concentration of the hydrochloric acid is doubled the rate of reaction will double and the reaction will be more exothermic.

Devise a plan, including the apparatus you would use, to test the student's prediction.

You are provided with pieces of zinc and two bottles of dilute hydrochloric acid. One bottle of hydrochloric acid is double the concentration of the other.

(6)

A plan to include some of the following points
- measure equal masses of zinc using balance
- measure equal volumes of acid using measuring cylinder/pipette/suitable named piece of apparatus
- pour acid in suitable container

- record initial temperature
- use of thermometer

- add zinc to acid
- place bung with delivery tube in container / reaction vessel immediately after the zinc is added
- use of timer
- start timer on addition of zinc
- measure volume of gas evolved using a delivery tube and inverted measuring cylinder/burette over water OR delivery tube and (gas) syringe
- record time to collect fixed volume of gas
- record final/highest temperature
- calculate the temperature increase

- repeat for procedure
- same initial temperature
- same size pieces of zinc
- same volume of acid

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(Total for Question 9 = 13 marks)

10 Figure 16 shows the structure of a molecule of dichloroethene.

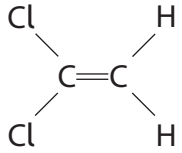


Figure 16

(a) (i) Describe how dichloroethene monomers form a polymer.

(2)

double bond (in monomer) breaks (1)

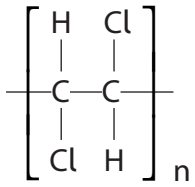
• {monomers/ molecules} link together (1)

• to form a (long) chain (1)

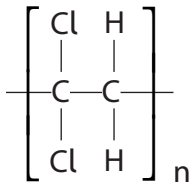
(ii) Which of these represents the structure of the polymer formed from the monomer in Figure 16?

(1)

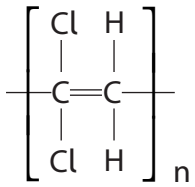
☒ **A**



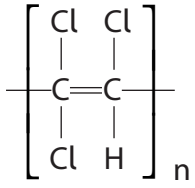
☒ **B**



☒ **C**



☒ **D**



(iii) Separate samples of dichloroethene and poly(dichloroethene) are shaken with a few drops of bromine water.

What would be **seen**?

(1)

- ☒ **A** both mixtures remain orange
- ☒ **B** only the dichloroethene and bromine water goes colourless
- ☒ **C** only the poly(dichloroethene) and bromine water goes colourless
- ☒ **D** both mixtures go colourless

(b) Dichloroethene is produced from ethene and chlorine.

In the overall reaction, ethene reacts with chlorine and forms dichloroethene and hydrogen chloride.

Complete the balanced equation for the overall reaction.

(2)

$$C_2H_4 + 2Cl_2 \rightarrow C_2H_2Cl_2 + \text{2HCl}$$

(c) Poly(dichloroethene) was used to wrap food to keep it fresh.

Explain **one** property that a plastic food wrapping must have.

(2)

non-toxic (1)
so stops food being poisonous (1)
OR
unreactive (1)
so it does not react with the food

(d) An industrial process uses 500 tonnes of dichloroethene.
In the process only 96.5% of the dichloroethene molecules react.

Calculate the mass of dichloroethene that has **not** reacted.

Give your answer to two significant figures.

(3)

100 – 96.5 = 3.5 (1)
500 x 3.5/100 (=17.5) (1)

= 18 (tonnes to 2 s.f.) (1)

mass = ... tonnes

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

The periodic table of the elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.